gives a valuable summary of the explorations and surveys made in 1895, and the museum and other work carried on under his direction. The separate reports contained in the volume are as follows :—

"The Country between Athabasca Lake and Churchill River," by J. Burr Tyrrell and D. B. Dowling.

"The Geology of a Portion of the Laurentian Area lying to the North of the Island of Montreal," by Frank D. Adams.

"Explorations in the Labrador Peninsula, along the East Main, Koksoak, Hamilton, Manicuagan, and portions of other Rivers, in 1892–93–94–95," by A. P. Low.

"Report of the Section of Chemistry and Mineralogy," by G. C. Hoffman.

"Report of the Section of Mineral Statistics and Mines," by E. D. Ingall.

These reports are published separately, and several of them have already been referred to in our columns of "Notes."

A Bibliography of Science. By William Swan Sonnenschein. (London : Swan Sonnenschein and Co., Ltd., 1897.)

THIS classified list of scientific books, extracted from two useful bibliographies prepared by the author a few years ago, will be valuable to readers who are outside the living stream of scientific thought. It is in no sense complete, and it does not pretend to be so ; nevertheless, it will serve a useful purpose. Some of the remarks of the editor may be resented by the authors of the books referred to. Thus, one book is described as "a somewhat slovenly and unscientific performance" (p. 384). If the criticism is a just one, the title of the book might have been omitted.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Zeeman's Phenomenon.

IN Section A at the Toronto meeting of the British Association, Dr. Lodge raised the question as to whether we should expect on a simple theory that the spectral lines should be simply widened or be doubled by magnetic force. The simple theory depends on the acceleration or retardation of electrons performing circular orbits under the action of a magnetic force normal to the plane of the orbit. If the plane of the orbit be not normal to the magnetic force, it might appear that the acceleration or retardation would be only that due to the component of the force normal to the plane of the orbit. From this it would follow that the lines would be *widened* and not *doubled*, because every intermediate acceleration or retardation would occur between the extreme cases of orbits perpendicular to the magnetic force. This suggested theory, however, overlooks the effect of the magnetic force in altering plane of the orbit. The complete theory can be very much more simply obtained by another method of attack. The motions being assumed simply periodic in the undisturbed motion, can be resolved for each electron into three linear vibrations, two at right angles to the magnetic force and one parallel to it. This latter is undisturbed and gives no light in the direction of the magnetic force. Each of the other linear vibrations is disturbed, and we can easily see how by considering that a linear vibration may be considered as due to two circularly polarised vibrations. Each of these component circular vibrations will be altered by the magnetic force normal to its plane, one being simply accelerated and the other retarded. We can consequently see that this more complete theory leads to the conclusion that the lines would be *doubled* and not *widened*, though, of course, they may be also widened owing to other disturbances of the motion. There would be no difficulty in writing down the equations of the resulting motion of the electron, but it seems hardly necessary to do so, as this geometrical analysis leads to the kind of vibration emitted, which is all that we can observe. GEO. FRAS. FITZGERALD.

Fort William, Ontario, August 28.

Coccoliths in our Coastal Waters.

ALTHOUGH much has been written about the problematical coccoliths, the presence of these bodies in our coastal waters does not appear to have been recorded. Our observations on the minute marine organisms off this coast (South County Dublin) show that they abound both near the shore and outwards to the limits we have hitherto investigated—some three miles into the Irish Channel.

The following preliminary account of their mode of occurrence, and some features of their structure may be of interest.

Our first finds were effected by means of a cone-shaped, metal, surface dredge ; the wide end guarded with wire gauze—about fifty meshes to the linear inch—and the narrow truncated end closed with fine brass gauze, having about 350 meshes to the linear inch. The dredge is floated horizontally by pine-wood wings, and when in operation is trailed behind a boat, the wide end forwards. At intervals the dredge is lifted, the finer gauze removed and washed in a little sea water.

Examination of the fine particles so gathered reveals many varieties of foraminifera, diatoms, a great abundance of peridineæ, sponge spicules, &c., and an amœboid body resembling *Difflugia pyriformis* in appearance. This last body, magnified about 900 diameters, is shown in Fig. 1. The drawing shows the organism as freshly dredged and extending finger-shaped pseudopodia from the open collar, which terminates one extremity of its urn-shaped case. Most usually it is observed with the pseudopodia retracted.

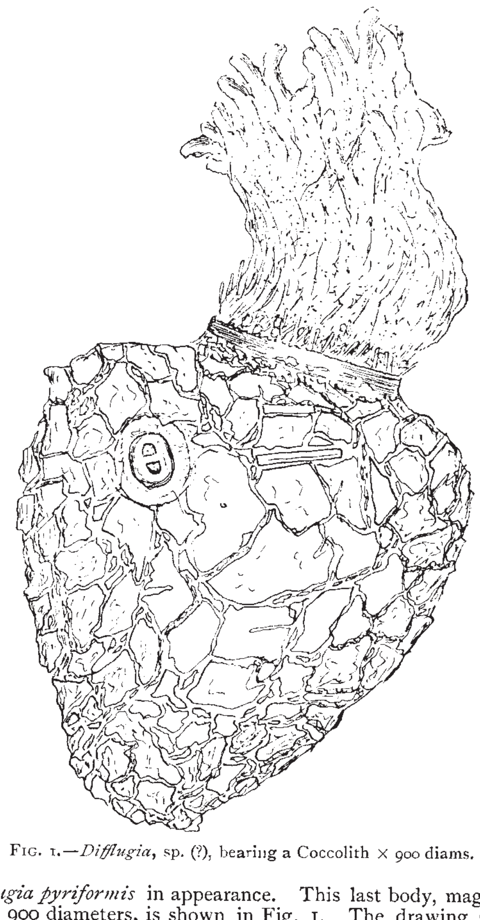

FIG. 1.—*Difflugia*, sp. (?), bearing a Coccolith × 900 diams.

The case enclosing the protoplasm is composed of minute grains of quartz sand (resist acids and alkalies), adhering in random fashion to the protoplasmic contents within. Also there will be seen in the figure (which is from a camera-lucida drawing) one small oval body, occurring among the sand grains.

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Reference to Dr. Murray's well-known figure of the coccoliths gathered from the surface waters of the North Atlantic, at once shows the close resemblance of both bodies. In a certain focal plane, indeed, the resemblance is even still more striking. Dr. Murray's drawing is reproduced in Mr. G. Murray's and Mr. Blackman's article appearing in NATURE, April 1, 1897, p. 510. It is of interest to note that Bütschli records the appearance of disc-shaped plates of uncertain origin in *Difflugia*.

The number of *Difflugia* present in our slides is very considerable, and of this number perhaps some 25 per cent. show one or two implanted coccoliths. Furthermore, the *Difflugia* are by no means confined to the immediate surface. Sinking our dredge to a depth of eight fathoms in Killiney Bay, we still obtained this organism; and varying states of wind and tide did not appear to affect its numbers.

The first question that arises is as to the relation which the minute adherent organisms bear to the *Difflugia* which carry them. The surmise naturally arrived at was that the relationship is accidental. The protozoan gathers its covering particles from such minute hard bodies as it finds convenient; among them it occasionally picks up an organised particle—the coccolith.

If this surmise as to the relations of the two organisms is correct, it must follow that examination of the most minute solid constituents of the sea water will reveal the presence of free coccoliths in considerable numbers. To test this question, some two litres of sea-water was permitted to stand twenty-four hours in a tall narrow jar; the upper part being then syphoned off, leaving some 200 c.c. of the lower portion. This was then treated in a centrifugal apparatus, readily fitted on a small dynamo, permitting a high rate of rotation. In this manner the water was cleared in a very short time of all turbidity, and a mat composed of its solid contents thrown to the bottom of the tubes of the centrifuge.[1]

Examination of this precipitated material showed at once that coccoliths in a free state abounded in the water, every slide showing not less than a few score of specimens. Fully provided with specimens thus favourably placed for observation, we were enabled to confirm our previous observations as to the structure and probable composition of these bodies.

As full details are hardly in place here, we will refer at once to Fig. 2 for perspective appearances of the organism. The figures are more in outline than our original drawings, to permit of more ready reproduction in these pages. Figs. *a* and *b* are perspective views of opposite faces of the valves. Fig. *c* is an edge view. We explain the appearances presented in these drawings with considerable confidence by the diametral section shown in Fig. *d*. The coccolith consists of two very thin, funnel-shaped, elliptical valves; a small valve attached by a central connection within a wider, and provided with minute radial striations sculptured apparently on the outer or convex surfaces of both valves; between forty and fifty striations going round the valves. The connection attaching the valves is rounded or slightly oval and apparently perforated axially by two D-shaped apertures, but occasionally a single oval opening traverses the collar; or, again, the cross-piece separating the D-openings appears incomplete, and is represented by projections extending into an oval opening. The more minute structure of the connecting neck or attachment is unknown to us. The valves are frequently found chipped and fractured, but, so far as observed, always rigidly connected one with another. Specimens considerably less in dimensions than the normal are occasionally found, but identical in form. The resemblance between our drawings and those given by Bütschli in his *Protozoa* (Plate 1, Figs. 2-5) at once confirms the view that these organisms are identical with those described by this authority as "Coccolithen." The organism is a most difficult and illusive object owing to its minuteness, transparency and complex structure. Our drawings are made with a 1/12 oil immersion of Leitz.

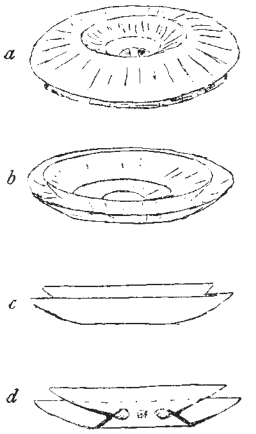

FIG. 2.—Coccolith × 2000 diams. q.p.

The coccoliths dissolve freely in dilute hydrochloric acid, and are partially and much more slowly attacked by strong caustic potash. The latter reagent does not appear to be able to completely dissolve the central parts, more especially of the lesser valve; or at least cannot do so with any celerity. The absence of the appearance of free gas upon attack with the acid hardly negatives the idea—agreeable with the observations of Dr. Murray and others—that these bodies are calcareous. In all these tests we have frequently had well-characterised diatoms present in the same field, and whereas the characteristic silicious covering of the latter held out against the acid, the coccolith immediately dissolved. In the application of the caustic potash test diatom valves were also present, and these showed complete resistance to the caustic alkali.

That there is some living matter present between the valves appears suggested by the granular appearance often presented in the ring embracing the central connection, and also by the fact that upon solution in dilute acid just such a ring of granular particles is thrown down, and alone remains to mark the spot where the coccolith had been. This granular remains assumes a tawny yellow or brownish colour when acted on by iodine. The inference is that a ring of (residual?) protoplasmic matter surrounds the central connection of the valves. Neither nucleus, flagellum, pseudopodia, nor cilia have as yet been observed, neither have we found any evident chromatophores.

In the present stage of our inquiry we can only ask with considerable uncertainty as to the nature and affinities of this interesting organism. Its rigidly attached valves, absence of girdle, and the calcareous nature of the valves, negative, we think, the idea that it is—as sometimes assumed—of diatomaceous nature. Its relationship with the Foraminifera is more probably suggested.

The possibility that they are commensal with, or parisitic on, the protozoan which so often carries them, must not be forgotten; at the same time our abundant free specimens appear so often ringed between the valves with proteid matter, that their independent existence appears highly probable. There is at present hardly data sufficient to render them referable with certainty to either one or the other kingdom of organised beings.

It may be assumed that they are abundant in our coastal waters as well as in the open ocean, where they in certain places bear a part in the formation of the Atlantic ooze. These circumstances, as well as their geological importance, confer great interest on the problem of their life-history—a problem the solution of which we do not think need be despaired of where such abundant materials are at hand.

J. JOLY.
H. H. DIXON.

Dalkey, August 27.

P.S.—Since the above was written we have found a few coccospheres in the water off this coast. These appear very scarce compared with the abundance of coccoliths. The abundance of the latter is remarkable. A sample of water taken some three miles from the shore on a calm day afforded, according to an estimate made with a divided stage, 200 coccoliths in each cubic centimetre of the sea-water! If this abundance obtains at other points along our coasts (we hope shortly to have results bearing upon this question), they must be one of the most abundant organic constituents of our seas.

We have found many specimens of the free coccoliths with a slimy proteid (?) attachment to the smaller valve.

Between crossed nicols the thin flange of the larger valve appears inactive; the entire inner ellipse, on the other hand, shows a dark-cross, the arms in some cases revealing a certain amount of spiral bending. A concentric and crystalline structure is thus suggested.

J. J.
H. H. D.

September 9.

A Bright Meteor.

ON Monday evening, the 6th inst., at 7.49 p.m. (Dublin time), I was walking from Blackrock to Dublin on the Blackrock road, and when passing by Booterstown I saw a very fine meteor of a brilliant white (such as the magnesium light) pass across the sky under the Plough at a slow rate, the course being parallel to the two lower stars of the four forming the Plough, and about the distance between the two "pointers" under it. It covered a flight of about 10° to 12°, and disappeared at a point about 15° to 20° above the horizon.

J. P. O'REILLY.

Dublin, September 9.

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[1] Later we netted them on silk in abundance.

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